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Conference Abstract

Measuring Morphological Functional Leaf Traits From Digitized Herbarium Specimens Using TraitEx Software

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Abstract

Herbarium specimens are of vital importance for understanding biodiversity. There are more than 350 million specimens stored in herbaria worldwide (Thiers 2018) Globally, many herbaria have undertaken digitization projects of plant specimens, on a massive scale, to preserve them and to make the images easily accessible to users.

Over the past years, with significant advances in the field of computer vision, new potential uses of digitized specimens have emerged, such as automated species identification using qualitative morphological traits. However, due to lack of efficient tools, efforts to extract functional (quantitative) morphological traits from digitized herbarium specimens are lagging behind. Functional trait data is of significant importance to understand the functioning of the ecosystem and interactions between biotic and abiotic factors. It is currently fragmented and initiatives such as TRY Trait database (https://www.try-db.org) are making efforts to fill the gaps in the observed trait matrix (Schrodt et al. 2015). In order to complement the global efforts, we have developed a software tool, TraitEx , which can measure quantitative traits such as the length, area, width and perimeter of leaves along with the petiole length from digitized herbarium specimens.

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TraitEx is a standalone Java-based open source tool developed after extensive interactions with biodiversity researchers. The main features of the tool are: (1) efficiently handling high-resolution specimen images, (2) accurately extracting measurements from specimens with varied leaf shapes that are mounted using white tape, (3) integrating ImageJ functionality (https://imagej.net/Welcome) to pre-process and edit the images, (4) measuring trait values to export in comma separated values (CSV) format along with original image and (5) reducing potential damage of fragile specimens, which might occur while physically measuring the traits.

Along with user guide and documentation, TraitEx tool is available at https://bitbucket.org/traitExTool/traitextool. The tool is made available under the BSD-2-Clause License.

Keywords

TraitEx, leaf traits, digitized specimens, herbarium, functional traits

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